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(54) Abstract Title

Vehicle child seat with inflatable restraint

(57) A child restraint system comprises a seat shell 2 with a restraining element such as a play table 6 and belt 7 and at least one inflatable gas cushion 14, 16 stored beneath the seat surface or at the upper portion of the seat back, the cushion being intended to restrain upward motion of the seat occupant in the event of an accident. The shell may be formed in a depression on a vehicle seat. Further inflatable cushions 15, 17 may be provided, eg in the side wing 5 of the shell or in the play table 6. The gas cushion may inflate forwardly, upwardly or rearwardly of the seating direction. The seat may be provided with belts (26-28 fig 2) some or all of which may be provided with inflatable cushions. The inflation of the cushion(s) may be controlled by a control device 20 receiving signals from a crash sensor, a contact switch 22, a position sensor and/or a child size sensor 18, 19. Several cushions may be activated commonly or separately, in sequence and with a degree of gas filling all dependent on the control device.

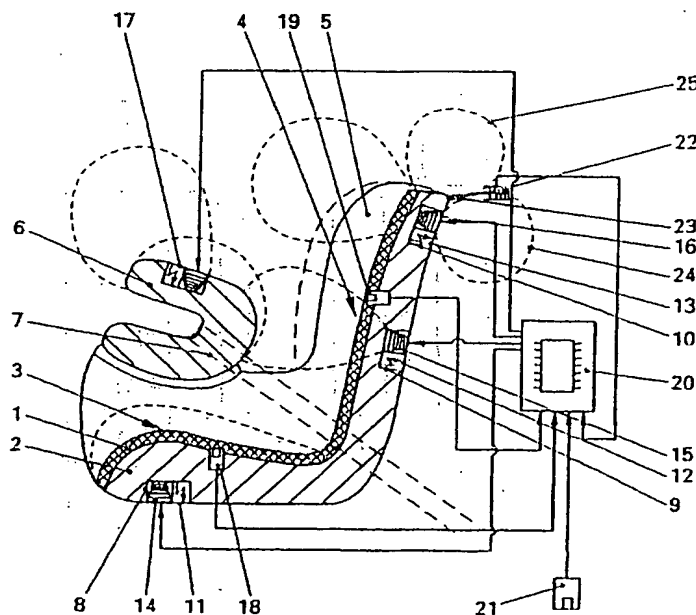


FIG 1

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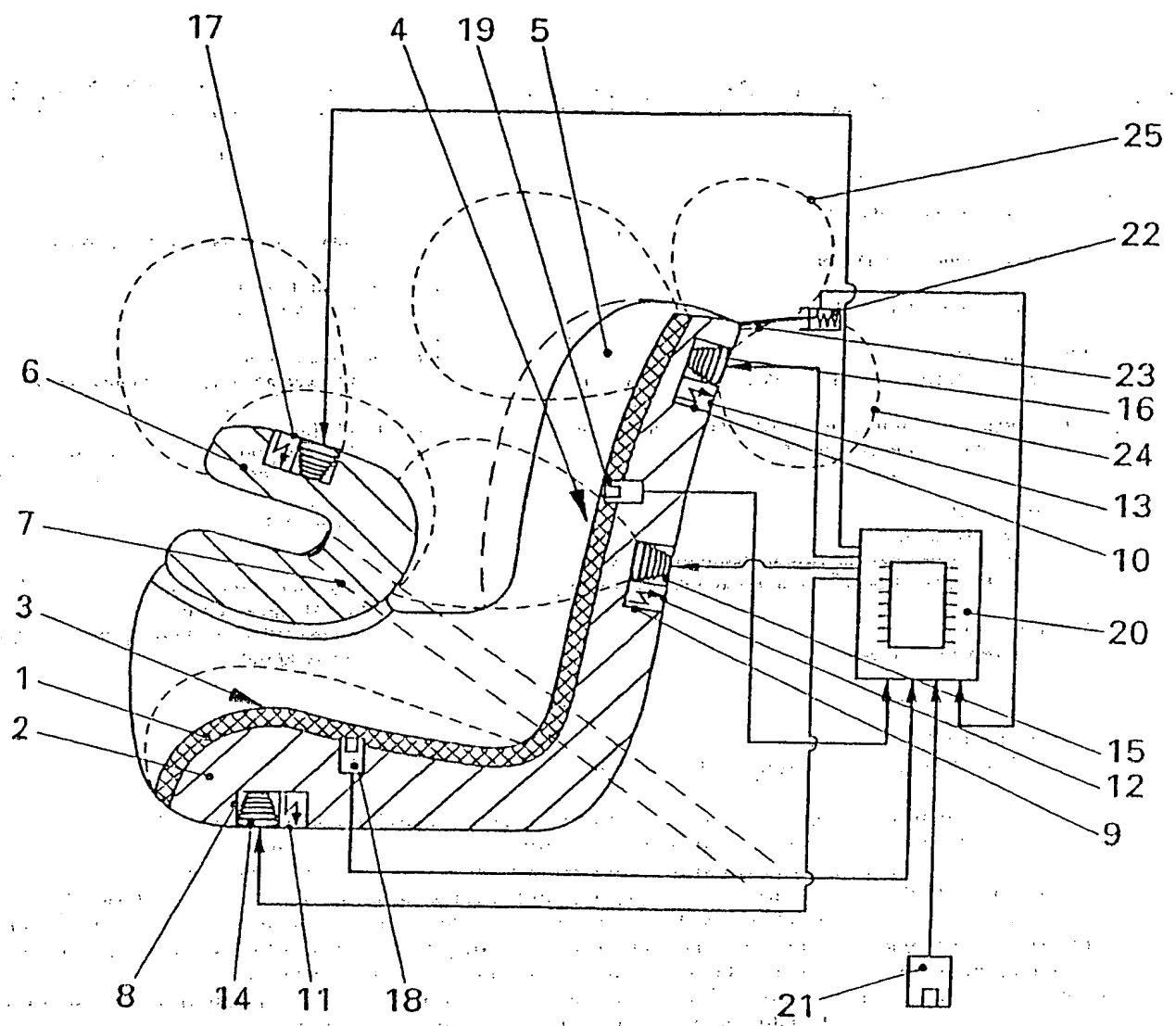


FIG 1

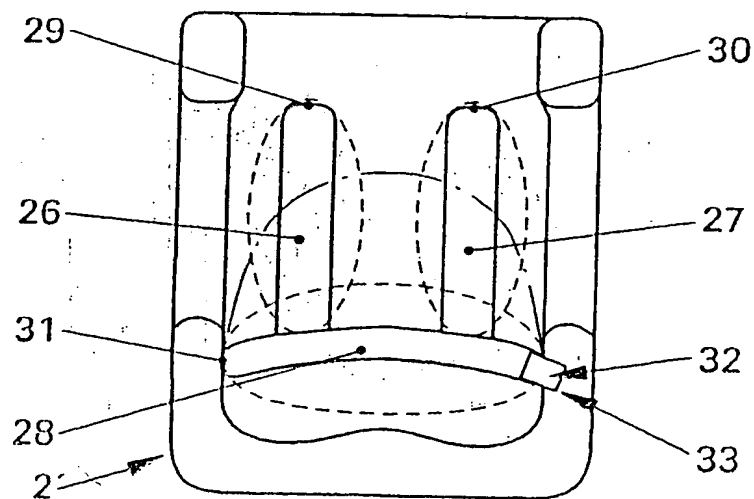


FIG 2

-1-  
DESCRIPTION

CHILD-RESTRAINING SYSTEM FOR USE IN A VEHICLE

The present invention relates to a child-restraining system for use in a vehicle.

Child-restraining systems in accordance with the generic type are known from DE-U1-91 12 614 (B60N 2/42) and DE-U1-92 08 309 (B60R 21/16). Essential components of these child-restraining systems are a shell in the form of a seat and a restraining element in the form of a play table which may be commonly secured to a vehicle seat by a safety belt. In the same way as in EP-03 83 123-B1 (B60N 2/26), an inflatable gas cushion is disposed in the play table in the manner of an air bag, in order to be able to softly brake the forward movements of the child's head and upper body which occur during a vehicle accident. Such a measure is particularly important for the protection of children, since, compared with adults, a child's head is far larger relative to the total body. Going beyond the protective effect of the restraining systems in accordance with generic type, arrangements for the air bag are also described in EP-03 83 123-B1 which increase the protective effect for the child, particularly in the case of side collisions. This is effected particularly by associating the inflatable gas cushions with side parts of a substantially bow-

shaped restraining device.

An aim of the present invention is to develop a child-restraining system in accordance with generic type in such a way that a good protective effect can be achieved for the child for a large number of different cases of stress and arrangements of the shell receiving the child.

According to the present invention there is provided a child-restraining system for vehicles, comprising a shell for at least partially receiving the child, at least one restraining element which is associated with the shell and which opposes displacement of the child as a result of an accident, and at least one gas cushion inflatable from a normal position, the shell being in the form of a carrier body for the inflatable gas cushion.

The construction, in accordance with the present invention, of the shell as a carrier body for the inflatable gas cushion makes it possible to prevent displacements of the child, caused by an accident, as early as possible. Thus, the child is correctly pressed against the shell by the inflated gas cushions. The inflation pressure is at the same time chosen in such a way that the child's body is not stressed to an inadmissible extent by the inflation operation itself. The restraining effect of the then

gradually relaxing gas cushion occurs only after the child's body has been fixed against the shell. By virtue of the present invention, it is possible first to position the child's body in a manner suitable for restraining it. This may be achieved by, for example, a stage gas generator, or by combining a softly inflating gas generator with a high-pressure gas generator. These generators may be coupled to so-called pre-crash sensors to thus make very early triggering possible and thus improves the protective effect.

In accordance with a first basic concept, the shell for receiving the child, is seat-shaped and its shape thus corresponds to the seating shells shown in the specifications describing the generic type.

In a second basic concept, the shell is tub-shaped in, for example, the manner of a perambulator bed, so that is especially possible to convey infants safely.

A third basic concept relates to children's seats which are an integral component part of a vehicle seat. Thus, a shell in the sense of the present invention is provided when upholstered elements are swung out of the back rest to produce a child's seating surface (see Test & Technik - auto motor sport 63- page 20 ff/1992). The remaining upholstered

elements produce in the back rest, or possibly also elements seating surface in other embodiments, a depression by which a carrier body in the sense of the invention is formed.

A further advantage of the present invention resides in the fact that, particularly in the case of seat-shaped shells in the so-called "reboard" arrangement i.e. rearwardly facing, the sliding of the child out of the seat, caused by inertia, may be prevented after frontal collisions. For this purpose, in a particularly advantageous embodiment, an inflatable gas cushion is disposed in the top region of the rest and, after activation by an accident sensor, limits the upward movement of the child. The inflation pressure of this gas cushion is at the same time chosen in such a way that, by limiting the movement, the child's neck is not stressed to a degree that is injurious to health. The sliding out of the child upwardly may also be prevented by a gas cushion disposed beneath the seating surface. The child's legs are fixed against the restraining element in the manner of a clamping action when a gas cushion arranged in this manner facing is inflated as the result of an accident. Thus, for seating shells arranged forwardly, so-called 'submarining', that is, the sliding of the child downwardly out of the seat,

may also be prevented. The previously described clamping action may also be achieved by a gas cushion which is disposed in the restraining element and which is inflated towards the rest part of the seating shell and/or the seating surface. An effect comparable to this is also achieved with an inflatable safety belt device coupled to the seating shell.

The construction, in accordance with the present invention, of the shell as a carrier body for the gas cushion, also offers the possibility of supporting the shell itself relative to the vehicle by way of gas cushions. By way of example, inflation of the gas cushion upwardly or rearwardly may be provided, for the already mentioned reboard arrangements of seat-shaped shells, in order to be able effectively to counter any possible impacting of the child's seat by an instrument panel or a windscreen. Pitching movements of the seating shell caused by an accident may also be reduced by this means. It is also conceivable to cover the entire outside of the seating shell with inflatable gas cushions so as to build up a protective gas envelope around the child's entire seat in the event of an accident. This is particularly important when, in the case of small cars for example, the child's seat has to be accommodated relatively close to a side wall, or when a further person is

) seated next to the child's seat subjected to a side collision.

It may also be ensured that an optimum protective effect can be provided for children of different age-groups by a plurality of individual gas cushions disposed side by side or, alternatively, by so-called multi-chamber air bags in conjunction with sensor systems or switch systems of corresponding design.

It is to be emphasised that commercially available air bag systems may be used to realise a child's seat which scarcely differs from the hitherto conventional seating shells with respect to its external dimensions and total weight. Known seating shells may be adapted for the use of air bag modules by simple modifications to tools. Particularly advantageous seating shells are those which have recesses into which an air bag module comprising a gas cushion and a gas generator may be fitted in the manner of a plug-in unit. Plug contacts are provided in the bottom of the recess for electrical signal lines which are in turn laid within the seating shell body and lead to a socket by which the entire child-restraining system is couplable to the electrical control device of the vehicle.

The present invention will now be further described, by way of example, with reference to the



accompanying drawings, in which:-

Preferred embodiments of the invention are illustrated in the drawings, in which:

Figure 1 is a cross-sectional side view of a preferred embodiment of the present invention; and

Figure 2 is a frontal view of another embodiment of the present invention.

A seating shell 2 covered with a layer 1 of upholstery is shown diagrammatically in Figure 1. Its essential portions are here a seating surface 3, a back rest part 4 and side wings, only one of which side wings is visible in this view and is designated 5. A restraining element in the form of a play table 6 is supportable on the side wings 5 and, together with the seating shell 2, is securable to a seat or a useful surface of a vehicle (not further illustrated) by way of a safety belt 7 indicated by broken lines.

For the purpose of constructing the shell 2 as a carrier body, it is provided with recesses 8 to 10 in each of which is fitted an air bag module formed by a respective one of gas generators 11 to 13 and a respective one of gas cushions 14 to 16 inflatable by the latter. A further air bag module 17 is located in the play table 6.

By way of example, a weight sensor 18 associated with the seating surface 3, or an infrared sensor 19

in the back rest part 4, may be provided for ascertaining the size of the child's body. The signals signalled by these sensors are fed to a control 20 to which signals may also be applied by a crash sensor 21 and a contact switch 22. By way of example, the contact switch 22 may be disposed in an instrument panel of the vehicle and is acted upon by an actuating rod 23 secured to the seating shell 2 as soon as the seating shell 2 has been properly positioned in a reboard arrangement. The triggering of an air bag disposed in the vehicle may also be suppressed by actuation of the contact switch 22.

Departing from the embodiments illustrated in the drawings, a single gas generator may be provided for the inflatable gas cushions 14 to 16 and acts centrally upon all the gas cushions, possibly through the intermediary of a valve system.

According to the type of accident, the individual gas cushions 14 to 16 may now be inflated commonly or separately by the control device 20.

A specific activation sequence may be predetermined according to the type of stress. In a preferred embodiment, the intervals of time between the activations are predetermined in dependence upon stress.

By way of example, the seating surface 3 may be

raised by activation of the gas cushion 14, thus fixing the child's legs against the play table 6. The same action may also be produced by the air bag module 17 accommodated in the play table 6. However, the gas cushion located therein is also inflatable in a conventional manner, so that an optimum restraining effect is produced in the case of a nodding movement of the head. The side wings 5 may be inflated forwardly as well as inwardly by activation of the gas cushions 15 and 16, thus effectively protecting the child particularly in the case of side collisions.

When in the positions designated 24 and 25, the entire seating shell 2 may be supported against the instrument panel or the windscreen of the vehicle, particularly in the case of the reboard arrangement. In this manner, the pitching movements of the entire seating shell 2 may be reduced to a minimum.

In the variant illustrated in Figure 2, the seating shell generally designated 2' is the carrier for an inflatable safety belt system whose chief elements are two braces-type belts 26 and 27 and a pelvis belt 28 hinged thereto. These inflatable belt elements also assume the pre-positioning and restraining functions already described above. Single-chamber or multi-chamber systems may be provided for the construction of the gas cushion formed from

the belt elements 26 to 28. The filling with propellant gas may be effected by way of gas generators which are integrated in the seating shell 2 and disposed in the region of hinge points 29 to 32. In the embodiment illustrated in the drawing, gas generators are associated with the hinge points 29 to 31 in the seating shell 2'. After the belt system has been applied, it is locked by means of a convention belt lock system 33. The braces-type belts 26, 27 may possibly be omitted if the pelvis belt 28 is inflatable towards the upper part of the child's body namely in accordance with the dash-dot line illustrated in Figure 2. The omission of braces-type belts facilitates handling and also eliminates errors resulting from faulty adjustments in the length of the braces-type belts.

The invention is not limited to the embodiments illustrated in the drawings, particularly with regard to the arrangement of the gas cushions and the associated inflation devices. Thus, for example, the number of gas cushions may also be reduced if the particular seating shell is to be associated with only a specific age-group of children. In this connection, it is important that a simple assembly for a seating shell adapted in accordance with the invention is possible, particularly in the case of a one-part

design of gas cushion surface and seat cover. The design and styling of hitherto conventional seating shells are in no way impaired by using the invention.

In a modified embodiment, holding elements are secured to the seating shell 2 and are couplable to vehicle seat support frames or support frames fixed to the body of the vehicle by, for example the Isofix system.

An optional number of the developments indicated further in the sub-claims may be combined with one another, thus obtaining comprehensive protection at a justifiable cost of construction and manufacture.

The belt system illustrated in Figure 2 may also be realised with or without braces-type belts even in shells which are designed in accordance with the second or third basic concept. For the latter, a partial covering of the upwardly directed opening with an inflatable cloth may be realised as an alternative or as an addition.

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CLAIMS

1. A child restraining system for a vehicle, comprising a shell formed in the shape of a seat for at least partially receiving the child, the shell serving as a carrier body for at least one inflatable gas cushion, at least one restraining element being associated with the shell and adapted to restrain displacement of the child in the event of an accident and the gas cushion in its inoperative state being disposed beneath a seat surface of the shell or in an upper region of a back support of the shell, such as to restrain upward motion of the child when inflated in the event of an accident.

2. A child-restraining system as claimed in claim 1, in which the shell is formed by a depression in a back rest and/or in a cushion of a vehicle seat.

3. A child-restraining system as claimed in claim 1 or claim 2, in which a further inflatable cushion is secured in part of a side wing of the shell.

4. A child-restraining system as claimed in any preceding claim, in which the gas cushion in the upper region of the back support of the shell is inflatable forwardly relative to the seating direction.

5. A child-restraining system as claimed in claim 1, in which the gas cushion in the upper region of the back support of the shell is inflatable upwardly out of part of the back rest.

6. A child-restraining system as claimed in any preceding claim, in which a gas cushion is provided which is inflatable rearwardly relative to the seating direction.

7. A child-restraining system as claimed in any preceding claim, in which the belt system has at least two braces-type belts and a pelvis belt.

8. A child-restraining system as claimed in any preceding claim, in which a further gas cushion is disposed in a restraining element in the form of a play table and is inflatable out of the play table towards, when in use, the thorax, pelvis and/or the legs of the child.

9. A child-restraining system as claimed in claim 1, in which the inflatable gas cushion may be activated by a control device which is connected to at least one sensor for the detection of an accident situation.

10. A child-restraining system as claimed in claim 9, in which the control device is connected to a position sensor by which the orientation of the shell in the vehicle is detectable.

11. A child-restraining system as claimed in claim 10, in which a child size sensor is provided by which the body size or the weight of the child is detectable.

12. A child-restraining system as claimed in

claim 1, in which the inflatable gas cushion is combined with a gas generator to form a modular unit which is insertable into recesses of corresponding construction in the shell.

13. A child-restraining system as claimed in claim 1, in which the surface layer of the gas cushion, folded together in its normal position, is an integral component of a covering of the shell.

14. A child-restraining system as claimed in claim 9, having at least two inflatable gas cushions, in which the gas cushions can be activated commonly or separately by the control device.

15. A child-restraining system as claimed in claim 14, in which a predetermined activation sequence is provided for separate actuation.

16. A child-restraining system as claimed in claim 14, in which the degree of filling of the gas cushions and/or the sequence with respect to time between a plurality of activations is predeterminable in dependence upon stress.

17. A child-restraining system as claimed in claim 14, in which at least one of the inflatable gas cushions is acted upon by a stage gas generator.

18. A child-restraining system as claimed in claim 1, in which retaining elements are provided on the shell for the purpose of coupling it to a support frame disposed in the vehicle.



19. A child-restraining system as claimed in claim 7, in which at least one braces-type belt is inflatable towards the upper part of the child's body to a volume producing a head-restraining and chest-restraining action.

20. A child-restraining system constructed and arranged substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.



Application No: GB 9802489.6  
Claims searched: 1 to 19

Examiner: Karl Whitfield  
Date of search: 20 July 1998

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B7B (BSBA, BSBCM, BSBCR)

Int Cl (Ed.6): B60N 2/26, 2/28, 2/42, B60R 21/18, 21/20, 21/22

Other: Online database: Derwent World Patents Index accessed via Questel

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X, P	DE 4328328 A1 (TIETZ) especially airbag 3	1, 3-5, 9 & 18
X	DE 4232124 A1 (MERCEDES-BENZ) especially figure 1	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.